CLAIMS

What is claimed is:

1. An analytic chemistry system, comprising a population of beads including separate subpopulations, each subpopulation carrying chemical functionality which changes an optical signature of the beads in the presence of targeted analytes, beads in each subpopulation having an optical signature which is encoded with a description of the chemical functionality carried by that subpopulation

2. The system described in Claim 1, wherein the beads are encoded using dyes.

3. The system described in Claim 2, wherein the dyes are entrapped within the beads and the chemical functionality is on surfaces of the beads.

4. The system described in Claim 1, wherein the beads are encoded using fluorescent dyes.

5. The system described in Claim 1, wherein the beads are encoded by controlling a ratio of at least two dyes.

6. The system described in Claim 1, wherein the chemical functionality changes the optical signature by producing an optically active chemical in the presence of targeted analytes.

7. The system described in Claim 1, wherein the optical signature is changed by the chemical functionalities of the beads by the presence or absence of a fluorescent signal.

8. The system described in Claim 1, wherein the chemical functionalities of the beads support sites for hybridization.

9. The system described in Claim 1, wherein the beads are affixed to a distal end of an optical fiber bundle.

10. The system described in Claim 1, wherein the beads are located within etched wells at terminal ends of optical fibers of the bundle.

11. A chemical analysis method, comprising

preparing separate subpopulations of beads, each subpopulation carrying chemical functionalities that change optical signatures of the beads in the presence of targeted analytes;

encoding optical signature of the beads in each subpopulation with a description of the chemical functionalities carried by that subpopulation;

combining the subpopulations to produce a system;

applying the system;

detecting changes in the optical signatures indicative of a presence of the targeted analytes; and

decoding optical signature of the beads to identify the chemical functionalities.

12. The method described in Claim 11, wherein encoding the optical signatures with the chemical functionalities comprises doping the beads with fluorescent dyes.

13. The method described in Claim 11, wherein encoding the optical signatures with chemical functionalities

comprises attaching encoding dyes to the beads.

14. The method described in Claim 11, wherein encoding the optical signatures with the chemical functionalities comprises controlling a ratio of at least two dyes carried by each bead.

15. The method described in Claim 11, further comprising:

encoding the beads with the chemical functionalities by entrapping dyes within or attaching dyes to the beads; and

applying the chemical functicnalities to the beads.

16. The method described in Claim 11, further comprising enabling the chemical functionalities to produce an optically active species in the presence of targeted analytes to change the optical signature.

17. The method described in Claim 11, further comprising changing the optical signature by the presence or absence of a fluorescent signal from the beads.

18. The method described in Claim 11, further comprising enabling the chemical functionalities to hybridize.

19. An analytic chemistry sensor, comprising:

a bundle of optical fibers;

a population of beads carrying chemical functionalities at a distal end of the fiber optic bundle, light from individual bead being coupled into separate or groups of separate fibers of the bundle for transmission to the proximal end of the bundle.

20. The sensor described in Claim 19, wherein each one of the beads is located within separate wells formed at terminal ends of optical fibers of the bundle.

21. The sensor described in Claim 20, wherein the wells are formed by anisotropic etching of the cores of the optical fibers with respect to the cladding.

22. The sensor described in Claim 19, further comprising a light source for exciting optically active chemicals bound to the chemical functionalities.

23. The sensor described in Claim 19, wherein the population of beads includes separate subpopulations, each subpopulation carrying a different chemical functionality and an optically interrogatable code descriptive of the chemical functionality.

24. The sensor described in Claim 23, further comprising a light source for exciting optically active chemicals bound to the chemical functionalities.

25. The sensor described in Claim 23, wherein code of each subpopulation comprises fluorescent dyes.

26. The sensor described in Claim 23, further comprising a filter and a frame capturing camera for detecting optical signatures indicative of a status of the chemical functionalities and optical signatures indicative of the encoding of the beads.

27. A method for constructing and using an analytic chemistry sensor, comprising:

forming wells at terminal ends of optical fibers within a bundle;

distributing beads carrying chemical functionalities within the wells; and

monitoring a status of the chemical functionalities from a proximal end of the bundle.

28. The method described in Claim 27, wherein forming the wells comprises anisotropically etching of cores of the optical fibers with respect to cladding.

29. The method described in Claim 27, further comprising forming a population of beads in the wells from separate subpopulations, each subpopulation carrying a different chemical functionality and an optically interrogatable code descriptive of the chemical functionality.

30. The method described in Claim 29, further comprising randomly distributing the subpopulations within the wells.

31. The method described in Claim 29, further comprising serially adding the subpopulations to the wells.